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BY- ZIMILES, HERBERT

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TWO EXPERIMENTS WERE CONDUCTED TO STUDY THE RELATIONSHIP BETWEEN A CHILD'S TOLERANCE FOR DELAY OF GRATIFICATION AND HIS ABILITY TO CONSERVE NUMBER AND PICTURES. OTHER MEASURES OF COGNITION ALSO WERE USED. TOLERANCE FOR DELAY OF GRATIFICATION WAS MEASURED BY THE CHILD'S DECISION TO RECEIVE A PACK OF CANDY AND A TOY ON THE DAY OF TESTING OR TO RECEIVE TWICE THE NUMBER OF ITEMS ON THE FOLLOWING DAY. THE SUBJECTS IN THE FIRST EXPERIMENT, KINDERGARTEN AND FIRST-GRADE BOYS, WERE DIVIDED INTO THREE SUBGROUPS--WHITE MIDDLE-CLASS, DISADVANTAGED NEGRO, AND JEWISH PAROCHIAL SCHOOL BOYS. THE SUBJECTS IN THE SECOND EXPERIMENT WERE A MORE CULTURALLY HOMOGENEOUS GROUP OF FIRST-GRADE PUBLIC SCHOOL BOYS. ANALYSIS OF THE DATA SHOWED THE CORRELATION BETWEEN TOLERANCE FOR DELAY AND VARIOUS MEASURES OF COGNITIVE FUNCTIONING TO BE POSITIVE BUT LOW, WITH THE MOST CONSISTENT RELATIONSHIP EXISTING BETWEEN CONSERVATION OF NUMBERS AND PICTURES AMONG THE FIRST-GRADE BOYS. THE CORRELATION BETWEEN TOLERANCE FOR DELAY AND CONSERVATION WAS GREATER THAN THAT FOR OTHER FORMS OF COGNITION PERFORMANCE. THIS SUGGESTS A MORE FUNCTIONALLY RELATED BOND BETWEEN THIS RELATIONSHIP THAN COULD BE ATTRIBUTED MERELY TO MATURATION. COMPOSITE TOLERANCE FOR DELAY SCORES VARIED SHARPLY WITH GROUP MEMBERSHIP. FIFTY PERCENT OF THE JEWISH BOYS CHOSE TO DELAY RECEIVING THE PRIZE, WHEREAS ONLY 20 PERCENT OF THE DISADVANTAGED NEGRO BOYS MADE THE SAME CHOICE. ALTHOUGH A BOY'S EARLY MODES OF IMPULSE CONTROL, AND CONTINGENCIES ASSOCIATED WITH HAVING TO SHARE A PRIZE WITH A SIBLING ARE FACTORS WHICH COULD EXPLAIN HIS TOLERANCE FOR DELAY, HIS TRUST IN THOSE PROMISING HIM THE PRIZE ALSO MUST BE CONSIDERED IN HIS DECISION TO DELAY GRATIFICATION AS IT IS A DETERMINANT IN THE RELATIONSHIP OF DELAY BEHAVIOR TO COGNITIVE FUNCTIONING. (JL)

COGNITIVE FUNCTIONING AND TOLERANCE FOR DELAY OF GRATIFICATION[1]

Herbert Zimiles

Research Division, Bank Street College of Education

Recent interest in the exploration of complex forms of intellectual functioning and their antecedents has led to a closer examination of social-emotional determinants of problem solving, conceptual thinking and related cognitive behaviors. The influence of emotion on thought and reasoning is at once self-evident and obscure. No single theory can encompass the patterns of interrelatedness which have been observed; a comprehensive and unifying explanation of these phenomena awaits further exposition of the manner in which they exist in nature.

In the present study, the child's tolerance for delay of gratification was studied in relationship to his ability to conserve number, and related measures of cognition. Conservation of number, the ability to recognize that two parallel rows of objects remain numerically the same after the objects in one row have been moved outwards so that it is longer than the other row, was identified by Piaget (1952) as signaling a more advanced stage in the child's cognitive development. He considers conservation as indicating the presence of operational thinking -- the ability to deal with reality in representational terms so that the child's response is no longer exclusively determined by the immediate stimulus. When confronted with the conflicting cues of length and number presented by the conservation task, the conserver remains influenced by the numerical relationships established before the displacement of objects and is no longer overcome by the compelling quality of the differences in length.

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The freedom from the impact of the immediate stimulus, evinced at the cognitive level by conservation behavior, would appear to be isomorphic with tolerance for delay of gratification behavior, at the affective level. Tolerance for delay, as it has recently been studied by Mischel (1961), is measured by observing S's stated choice between two alternatives offered to him: a lesser reward to be received immediately, or a greater reward to be received after some specified period of delay. As in conservation, the child's response is affected by his ability to withstand the appeal of the immediate stimulus in favor of alternative considerations. It may be postulated that the ability to postpone gratification in behalf of greater pleasure in the long run, fosters the development of a perspective which permits the child to transcend the immediate stimulus in cognitive functioning. Conservation most closely resembles the elements involved in the tolerance for delay paradigm but it may be postulated that all forms of cognition which go beyond the mere processing of sensory input are related to, if not derived from, the child's tolerance for delay of gratification. This formulation is congruent with Freud's (1911) assertion that the introduction of a delay between the onset of a stimulus and the response to it, marks the beginning of ego functioning.

Method

Subjects

Two experiments were conducted. In Experiment I, the sample consisted of 51 kindergarten boys and 61 first grade boys, ranging in age from 5.3-6.3 years and 6.3-7.3 years respectively. The samples from both age groups were divided among three subgroups, selected from white middle-class, disadvantaged Negro, and Jewish parochial school populations. Experiment II Ss comprised a more culturally homogeneous group of 80 first grade boys ranging in age from 6.3-7.3 years, selected from public school populations.

Measures

1. Conservation of Number. Ss in Experiment I were given a series of six trials, and Ss in Experiment II, a series of eight trials, in which they were asked to compare the number of objects in two rows, after the objects in one of them were outwardly displaced. The nature of the objects -- either blocks or toy trucks -- and the number in each row -- from three to nine -- varied from trial to trial according to the experimental design of another study conducted with the same Ss concurrently. In each trial the two rows of objects were presented in parallel lines and their equivalence noted; then one row was lengthened by outwardly extending its objects without changing its number, and S was asked: "Are there more blocks in this row or in that row, or are there the same number?" Performance was categorized according to those who passed every conservation item -- conservers, those who failed all conservation items -- non-conservers, and those who passed only some of the items -- mixed conservers.

2. Conservation Pictures. This material consisted of 11 cards on which sets of paper seals of familiar objects, for example, birds and flags, were pasted in rows resembling the final phase of the conservation problem, that is, where one row is longer than the other, so that conflicting cues regarding length and number were presented without previous unambiguous establishment of the actual numerical relationship between rows as was done in the conservation of number procedure.

3. Tolerance for Delay. Adapted from the work of Mischel, a group procedure in the classroom was employed to obtain two successive measures of tolerance for delay. The children were told that they would receive some candy (and shown a pack of lifesavers) and then were presented with a choice. They were asked to indicate on clearly marked paper ballots whether they

wished to receive one pack now or two tomorrow, and were assured that they would receive the candy, as they specified, provided they indicated their preference on the ballot without consulting any classmates. Care was taken to make sure that each child understood how to use the ballot and responded independently of his neighbor. Immediately following this administration, they were given the same choice with respect to a toy -- a small rubber ball attached to a rubber band. Their responses were categorized according to those who preferred to wait on both items, those who preferred the immediate, lesser gift on both items, and those who responded in mixed fashion.

A number of other measures of cognition were obtained in relation to another study but yielded data relevant to the present study as well:

4. Draw-a-Person Test. Scored according to Harris' revision (1963) of Goodenough's method for assessing I.Q., this test was administered to all Ss.

In addition, Experiment I Ss were administered:

5. WISC Vocabulary Test.

6. Children's Embedded Figures Test (Karp and Konstadt, 1963).

7. Picture Vocabulary Test. This test was constructed such that each item presented pictures of three objects belonging to the same class that could be differentiated from one another in terms of some more specific referent.

8. Differentiation of Other Magnitudes Test. A series of item sets was constructed in which S was to designate which of two objects was greater in magnitude on a particular dimension when the objects also varied in a related dimension. Among item sets requiring the differentiation of depth from width, thickness from length, height from width, and age from height, only the age vs. height items were difficult enough to produce variance among Ss.

Results and Discussion

The correlations between measures of tolerance for delay of gratification and conservation of number and conservation pictures scores, as well as other measures of cognitive functioning, are presented in Table 1. It may be observed that the correlation of tolerance for delay of gratification with various measures of cognitive functioning tends to be positive but low. The most consistent relationship was found between tolerance for delay and both conservation of number and conservation pictures scores among the first grade children. None of this group of coefficients exceeds .36; less than 15 per cent of the variance in conservation behavior can be accounted for by variation in tolerance for delay of gratification as measured in the present study. However, when the subgroups constituting the Experiment I and II samples were considered separately (see Table 2), correlations as high as .48 in the middle-class group of first graders, and .46 in the disadvantaged group of first graders were found between conservation and tolerance for delay scores. Thus, portions of the data based upon subsamples support the proposition that relatively strong relationships between measures of tolerance for delay and conservation exist in some populations.

The data suggest that a substantially stronger relationship between tolerance for delay and conservation exists among the older groups of children. This trend may be attributable to the greater reliability of measurement likely to occur with older children. An alternative explanation postulates that the factors which the two measures have in common serve to differentiate between children who lag in the development of conservation behavior and the preponderance of their age-mates who show conservation (as in the case of first grade Ss where 64% were conservers) rather than between children who are relatively advanced in their development and the rest of their age group (among the

kindergarten Ss, only 35% were conservers).

Since the correlation between tolerance for delay and conservation is greater than that found with other forms of cognitive performance, this relationship cannot simply be attributed to a third common factor of maturity level. If a high score on the tolerance for delay is symptomatic of a generalized advance in development, it should be accompanied by heightened scores on all cognitive tasks, not merely conservation. The data suggest that a more functionally related bond between conservation and tolerance for delay is involved.

Undoubtedly, some of the relationship with cognitive measures has been attenuated by the unreliability of the tolerance for delay measures. The tetrachoric correlation between responses given to the candy and toy test items is .77; the children's preferences on each of the two separate test situations were closely related but not identical. Evidence for the presence of substantial amounts of systematic variance in the composite tolerance for delay score comes from the fact that it varied sharply as a function of the group membership of S. Fifty per cent of the Jewish parochial school children in the study indicated a preference for waiting for the larger delayed prize on both items, whereas only 20 per cent of the Negro disadvantaged group indicated a similar choice. Similarly, 48 per cent of the Negro disadvantaged group, in contrast with 32 per cent of the Jewish parochial group, chose to receive both of the lesser prizes immediately. Data obtained from larger samples indicate even greater differences between these two groups (Zimiles, 1965).

It should, of course, be noted that other, more contemporaneous factors, besides early modes of achieving impulse control during the onset of ego functioning, must be taken into account in explaining the child's response to the tolerance for delay situation. When asked why they chose as they did,

many children explained their response in terms of contingencies associated with their siblings. Some chose two toys or two candies because otherwise their sibling would take the one gift away or they would at least have to share it with him; others chose to receive only one gift since the other would have to be given to their sibling anyway.

Perhaps more important, the decision to forego immediate gratification for greater gain in the long run may be considered wise only if it is reasonable to trust those promising the delayed gift. In settings where the future is unpredictable or where promises are repeatedly broken, it makes more sense to take the bird in the hand. While this consideration may be expected to affect the child's mode of planning as well as other characteristics associated with the development of his cognitive style, the issue of trust represents still another determinant of tolerance for delay behavior to be reckoned with in relating this attribute to cognitive functioning.

Further work in this area should focus on developing more sensitive indicators of tolerance for delay -- establishing whether it is indeed a unidimensional trait -- and providing a more refined analysis of the factors which contribute to its variance. Once this is achieved, a more decisive test of the relevance of this variable to the child's cognitive functioning can be effected.

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Table 1

Correlations Between Tolerance For Delay and Measures of Cognition

Cognition Measures	Experiment I		Experiment II
	N = 51 Kindergarten	N = 61 Grade 1	N = 80 Grade 1
Conservation of Number	-.02	.31*	.23*
Conservation Pictures	-.02	.36**	.30**
Draw-a-Person	-.15	.17	.03
WISC Vocabulary	-.28*	.21	--
Embedded Figures Test	.14	.12	--
Picture Vocabulary	-.10	.09	--
Differentiation of Age and Height	-.08	.11	--

* $p < .05$, ** $p < .01$

Table 2

Within-Group Correlations Between Tolerance For Delay and Conservation

Experiment I	Conservation of Number		Conservation Pictures	
	Kindergarten	First Grade	Kindergarten	First Grade
White Middle Class	.16 (N=17)	.34 (N=24)	.40*	.48*
Negro Disadvantaged	.00 (N=14)	.46* (N=16)	-.38	.42
Jewish Parochial	.00 (N=20)	.33 (N=21)	-.12	-.04
All Groups Combined	-.02 (N=51)	.31* (N=51)	-.02	.36**

Experiment II	Conservation of Number	Conservation Pictures
School Group A (N=48)	.07	.25*
School Group B (N=32)	.40*	.32*
Both Groups Combined (N=80)	.23*	.30*

* $p < .05$, ** $p < .01$